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STUDY OF THE COMPOSITION OF COMPOUND $CuZnSe_2$ WITH THE STRUCTURE OF KESTERITE OBTAINED BY HYDROCHEMICAL DEPOSITION

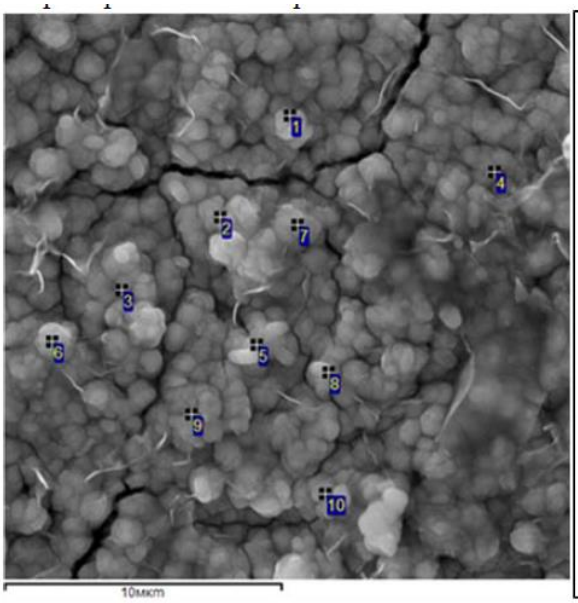
A. A. Timina,[1] L. N. Maskaeva,[1,2] V. F. Markov[1,2]

[1]Ural Federal University named after the first President of Russia B. N. Yeltsin.
Mira St., 19. Yekaterinburg, 620002, Russia
[2]Ural Institute of State Fire Service of EMERCOM of Russia,
Mira St., 22. Yekaterinburg, 620137, Russia. E-mail: aatimina@mail.ru

Abstract. In order to obtain a three-component structure of $CuZnSe_2$, a method of hydrochemical layer-bylayer deposition of individual films of $Cu_{1.96}Se$, ZnSe chalcogenides at 353 K for 120 and 90 minutes, respectively, was implemented. The formation of the compound under discussion was carried out by applying these layers to the substrate in the following sequence $Cu_{1.96}Se$ / ZnSe, the thicknesses of which are in a ratio of 1.03:1.10 with subsequent annealing of the resulting sandwich structure for 20 minutes at a temperature of 573 K.

The content of the main elements (Cu, Zn, Se) in the studied semiconductor structure was determined over the entire surface area using energy dispersive microanalysis. As an example, Fig. 1 shows its results with an indication of the local areas in the electron microscope image in which the elemental analysis was performed.

According to the results of EDX analysis, it should be noted that both individual crystallites and the entire surface of the Cu-Zn-Se structure contain copper, zinc and selenium, the average content of which is 25.66, 24.86, and 49.48 at. %. The results obtained indicate a slight non-stoichiometry of the researched compound: the ratio of the sum of metals (Cu + Zn) to Se chalcogen is 1.02 and 1.0. Consequently, a chalcogenide layer of the composition $CuZnSe_2$ with the structure of kesterite[1] was first obtained by chemical precipitation from aqueous media.



Spectrum	Cu	Zn	Se
1	21.40	26.70	51.90
2	29.00	24.83	46.17
3	28.24	22.34	49.41
4	26.83	23.89	49.28
5	29.44	21.94	48.62
6	20.14	29.81	50.05
7	26.08	24.90	49.03
8	21.34	27.49	51.17
9	22.72	26.34	50.94
10	31.41	20.33	48.26
Average	25.66	24.86	49.48

Figure 1. The results of energy dispersive analysis of the three-component structure of $CuZnSe_2$, formed by layer-by-layer deposition at 353 K of films $Cu_{1.96}Se$ and ZnSe, the duration of synthesis of which is 120 and 90 min, respectively

References

1. Effect of magnesium incorporation on solution-processed kesterite solar cells / R. Caballero, S. G. Haass, C. Andres [et al.] // Frontiers in Chemistry. – 2018. – Vol. 6. – P. 1–9.